What is claimed is:

1. A titanium alloy comprising:

when the entirety is taken as 100% by mass,

at least one alloying element selected from the group consisting of molybdenum (Mo), vanadium (V), tungsten (W), niobium (Nb), tantalum (Ta), iron (Fe), chromium (Cr), nickel (Ni), cobalt (Co), copper (Cu) and aluminum (Al) in a molybdenum equivalent "Mo_{eq}" of from 3 to 11% by mass, the molybdenum equivalent determined by the following equation,

$$Mo_{eq} = Mo_{mass} + 0.67V_{mass} + 0.44W_{mass} + 0.28Nb_{mass} + 0.22Ta_{mass} + 2.9Fe_{mass} + 1.6Cr_{mass} + 1.1Ni_{mass} + 1.4Co_{mass} + 0.77Cu_{mass} - Al_{mass},$$

wherein Mo_{mass}, V_{mass}, W_{mass}, Nb_{mass}, Ta_{mass}, Fe_{mass}, Cr_{mass}, Ni_{mass}, Co_{mass}, Cu_{mass} and Al_{mass} are expressed in percentages by mass;

at least one interstitial solution element selected from the group consisting of oxygen (O), nitrogen (N) and carbon (C) in an amount of from 0.3 to 3% by mass; and

the balance of titanium (Ti);

the content of Al being controlled to 1.8% by mass or less; and

being β single phase at room temperature at least.

2. The titanium alloy set forth in claim 1, wherein the interstitial solution element is O.

3. The titanium alloy set forth in claim 1 being of flexibility to exhibit a Young's modulus of 70 GPa or less.

4. The titanium alloy set forth in claim 1 being of high strength to exhibit a tensile strength of 1,000 MPa or more.

5. The titanium alloy set forth in claim 1 being of high elasticity to exhibit an elastic deformability of 1.6% or more.

6. The titanium alloy set forth in claim 1 further comprising at least one additional alloying element selected from the group consisting of zirconium (Zr), hafnium (Hf), scandium (Sc), manganese (Mn), tin (Sn) and boron (B) in an amount of from 0.1 to 10% by mass.

7. A process for producing a titanium alloy, comprising:

subjecting a raw titanium-alloy material to a solution treatment,

the raw titanium-alloy material comprising:

when the entirety is taken as 100% by mass,

at least one alloying element selected from the group consisting of Mo, V, W, Nb, Ta, Fe, Cr, Ni, Co, Cu and Al in a molybdenum equivalent "Mo_{eq}" of from 3 to 11% by mass, the molybdenum equivalent determined by the following equation,

$$Mo_{eq} = Mo_{mass} + 0.67V_{mass} + 0.44W_{mass} + 0.28Nb_{mass} + 0.22Ta_{mass} + 2.9Fe_{mass} + 1.6Cr_{mass} + 1.1Ni_{mass} + 1.4Co_{mass} + 0.77Cu_{mass} - Al_{mass},$$

wherein Mo_{mass}, V_{mass}, W_{mass}, Nb_{mass}, Ta_{mass}, Fe_{mass}, Cr_{mass}, Ni_{mass}, Co_{mass}, Cu_{mass} and Al_{mass} are expressed in percentages by mass;

at least one interstitial solution element selected from the group consisting of O, N and C; and

the balance of Ti;

the content of Al being controlled to 1.8% by mass or less;

the solution treatment comprising the steps of:

heating the raw titanium-alloy material to form β single phase therein; and

quenching the heated raw titanium-alloy material,

whereby producing a titanium alloy being β single phase at room temperature at least.

8. The process set forth in claim 7, wherein the raw titanium-alloy material is held at a β transformation temperature or more at which the raw titanium-alloy material is turned into β single phase for from 1 to 60 minutes in the heating step.

9. The process set forth in claim 7, wherein the heated raw titanium-alloy material is quenched at a cooling rate of from 0.5 to 500 K/sec. in the quenching step.

10. The process set forth in claim 7, wherein the raw titanium-alloy material further comprises at least one additional alloying element selected from the group consisting of Zr, Hf, Sc, Mn, Sn and B in an amount of from 0.1 to 10% by mass.